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AUTHOR	Clark, Karen B.
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ABSTRACT

This paper reviews research about the use of technology with students with disabilities to enhance behavior, monitor progress, and improve learning. It also provides helpful references for teacher educators. The belief that the appropriate use of technology can enhance learning for all students is reflected in different standards for teacher education programs. Standards, such as those developed by the National Council for Accreditation of Teacher Education, the Interstate New Teacher Assessment and Support Consortium, and the Council for Exceptional Children are used for the accreditation of general and special teacher education programs. Other standards such as those developed by the International Society for Technology in Education provide more detailed descriptions of the competencies expected of both general and special education teachers. In light of these standards and the fact that all educators are likely to work with students with disabilities, teacher education programs are revising courses that prepare future teachers to use technology with all learners. These courses should be designed to reflect research-based practices. The purpose of this paper is to provide an overview of different uses of technology that support students with disabilities. The overview is organized according to specific classroom uses of technology with students with disabilities. These include: technology to enhance behavior, technology to monitor student learning, and technology to enhance academic achievement. In each section a potential use of technology is described along with a discussion on related research. (Contains 34 references.) (Author/AEF)

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Research, Students with Disabilities, and Technology: Guidelines for Teacher Educators

Karen B. Clark

Indiana University South Bend

Kbclark@iusb.edu

(219)237-4350

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Abstract

KEYWORDS: technology, students with disabilities, teacher education, learning disabilities

In light of new technology-related standards used to evaluate teacher education programs, courses related to the use of various technologies to improve learning are being revised. In addition, future teachers must be prepared to teach all learners, even those with disabilities. As educators redesign courses, it is important that they do so with an eye for research-based practices. This paper will review some research about the use of technology with students with disabilities to enhance behavior, monitor progress, and

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improve learning. In addition, it will provide some helpful references for teacher educators.

The belief that the appropriate use of technology can enhance learning for all students is reflected in different standards for teacher education programs. Standards, such as those developed by the National Council for Accreditation of Teacher Education (NCATE), the Interstate New Teacher Assessment and Support Consortium (INTASC), and the Council for Exceptional Children (CEC) are used for the accreditation of general and special teacher education programs. Other standards such as those developed by the International Society for Technology in Education (ISTE) provide more detailed descriptions of the competencies expected of both general and special education teachers.

In light of these standards and the fact that all educators are likely to work with students with disabilities, teacher education programs are revising courses that prepare future teachers to use technology with all learners. These courses should be designed to reflect research-based practices. Therefore, the purpose of this paper is to provide an overview of different uses of technology that support students with disabilities.

In order to be most helpful, this overview is organized according to specific classroom uses of technology with students with disabilities. These include, technology to enhance behavior, technology to monitor student learning, and technology to enhance academic achievement. In each section a potential use of technology is described along with a discussion on related research.

Technology to Enhance Behavior

The use of technology to help change behavior involves the use of relatively low-tech equipment that is available in most school settings. Two types of technology that can be very useful for changing behavior include the use of audiotapes to promote self-regulation and self-monitoring of behavior (Johnson & Johnson, 1999), and the use of videotapes to encourage appropriate behavior via self-modeling (Buggey, 1999). In addition to requiring technology that is typically available, self-regulation and self-modeling seem appropriate for use with students across grade levels (Buggey, 1995; Maag, Reid, & DeGanni, 1993; Kahn, Kehle, Jensons, & Clark, 1990).

Teaching self-regulation of behavior typically involves helping students observe, assess, record, and reinforce their own behavior. The use of an audiotape with tones that sound at variable intervals is typically used in the beginning stages after having identified a target behavior and teaching students to ask a monitoring question. For example, when the tone sounds, students ask a monitoring question such as, "Was I looking at, or reading my book or paper?" If the answer is yes, the student indicates this on-task behavior on a recording sheet that has been provided.

The use of videotaped self-modeling (VSM) has been used successfully to enhance motor skills (Dowrick, 1983), cognitive skills (Schunk & Hansen, 1989), and behavior (Buggey, 1999). When using VSM, teachers must identify a target behavior and teach the behavior using role playing with the identified student. The student can then be videotaped demonstrating the appropriate behavior during the role play. Tapes are typically brief and only positive examples of behavior are included. Research suggests that viewing the tapes for 3 - 5 minutes per day can result in positive changes in behavior.

Videotaping with adult feedback was used successfully as part of a program by McCullough, Huntsinger, and Nay (1977) to teach an adolescent to control his aggressive behavior in a school setting. In this study, the student was videotaped during a role-playing situation. The student then reviewed the videotape with an adult to identify his own aggressive behaviors and to determine their effect on others. The use of this videofeedback resulted in reducing the frequency and intensity of aggressive behavior.

Sufficient research exists to support the use of audiotapes and videotapes to produce positive changes in behavior when used appropriately with students with various disorders and disabilities. While this technology may not be computer-based, teachers should be made aware of its potential for use in the general education setting. Also consideration could be given to integrating VSM into other forms of multimedia for instructional purposes.

Technology to Monitor Student learning

Computer Grade Book Programs

Students with disabilities, particularly those with learning disabilities, often have deficits in their metacognitive awareness (Swanson, 1996). These deficits make it difficult for some students to monitor their own learning. Monitoring one's learning would include the ability to determine progress toward goals and to evaluate the quality of one's work. Computer technology that allows students to independently check on requirements and due dates for homework assignments and access grades on an ongoing basis would seem beneficial to many students.

Research indicates that low achieving students often misunderstand even simple grading practices (Evans & Engelberg, 1998). The ability to access grades on an ongoing basis shows promise for improving task completion and improving academic performance (Hunter & Chen, 1992). Since this field test completed with seventh grade low-achieving students (Hunter & Chen, 1992), schoolwide technology that allows students to access grades has become easier to use and readily available. Such technology may be referred to as student information systems software, gradebook software with web interfaces, or courseware management software. The ability to access this information using a web browser can also improve parent-school communication. In addition, current standards demand that students be active participants in the assessment process (IPSB, 1998).

CBM software and graphing programs

Curriculum-based measurement (CBM) has a sound research base to support its use as a method for monitoring student progress and making databased instructional decisions (Stecker & Fuchs, 2000). CBM relies on short-timed probes conducted on an ongoing basis to assess student progress in reading, mathematics, spelling, and written expression. Progress is assessed using measures of fluency which are then graphed to provide a visual representation of student learning.

Monitoring Basic Skills Progress (MBSP) is a software program available to assist teachers interested in using CBM. With this software the computer administers and scores tests, provides students with immediate feedback, saves students' scores and prepares graphs displaying progress over time. These programs also analyze the graphed

performance and provide teachers with suggestions for instructional changes. Future teachers should be aware of the potential of CBM to enhance student learning.

IEP Software

A recent report by the Council for Exceptional Children (2000) suggests that all special educators should be given state of the art case management software and the training necessary to use it effectively. Clearly teacher education programs can begin such training by requiring future special educators to develop competence with IEP management software. In addition, special educators should be acquainted with research that suggests computerized IEPs might have some unintended disadvantages.

Schenck (1981) has suggested that without proper preservice training, we may find that we reduce paperwork demands, but undermine the validity of the IEP. Majsterek, Wilson, and Mandlebaum (1990) provided some early suggestions for evaluating IEP software. Their guidelines encourage the prospective teacher to examine the software for its consistency with required components of the IEP, hardware requirements, amount of time to learn, and compatibility with curriculum. In addition, special educators should review programs with an eye for the ability to individualize goals and objectives, and to customize these so they are compatible with state standards.

Technology to Enhance Academic Achievement

Computer-assisted Instruction

Researchers have been interested in the use of computers to enhance the academic achievement of students with disabilities since the mid 1980s (Woodward & Rieth, 1997). Much of this research investigated the effect of various design features including feedback

(Collins, Carnine, & Gersten, 1987; Torgesen, Waters, Cohen, & Torgesen, 1988), massed and distributed practice (Hasselbring, Goin, & Bransford, 1988), and explicit strategy instruction (MacArthur & Haynes, 1995). Later researchers began to investigate videodisc programs (Kelley, Gersten, & Carnine, 1990) and anchored instruction (Cognition and Technology Group at Vanderbilt University, 1990). It was much later before researchers began to investigate the use of computer-assisted instruction with students with autism and low incidence populations (Higgins & Boone, 1996).

Extensive reviews of research investigating technology and academic achievement of students with disabilities are available and should be examined by both general and special educators (Fitzgerald & Koury, 1996; Shiah, Mastropieri, & Scruggs, 1995; Woodward & Rieth, 1997). In addition, a separate review of technology applications and literacy skills may also be helpful to educators (MacArthur, Ferretti, Okolo, & Cavalier, 2001) and will be referred to in the section on technology and writing. Results of this research is mixed, however, the research on the use of computer-assisted instruction with students with disabilities suggests that the computer is as effective as teacher directed instruction in one-on-one instructional arrangements (Higgins & Boone, 1990; Higgins & Boone, 1992). The critical role for teachers may be to select software that incorporates the critical variables found to promote learning along with determining the best ways to connect computer-based instruction with traditional instruction (Woodward & Rieth, 1997).

Software and Multimedia Selection

The importance of teachers' ability to select carefully designed software was highlighted in a study by Higgins, Boone, and Williams (2000). These researchers contacted 33 educational software publishers to request information about the product development practices, specifically those related to field-testing. Of these 33 publishers, five admitted they did not engage in any evaluation of their products. This cavalier attitude on the part of software publishers makes it critical that educators understand variables to consider when selecting software for use with students with disabilities.

Educators can find a comprehensive set of guidelines in an article by Higgins, et al. (2000). These scholars provide a flowchart for guiding classroom teachers through the necessary steps in evaluating software and a specific list of critical components to keep in mind when examining specific programs. The components related to enhancing learning to be evaluated include: teacher options, software options and design, screen design, instructional options, sound, feedback, and instructional and screen design. Equally important are the steps in the flowchart where teachers are encouraged to create pretests and posttest measures to determine student learning. Finally, these researchers also include a set of questions for interviewing students to determine their perceptions of software effectiveness.

A similar article by Wissick and Gardner (2000) presents a comprehensive overview of effective instructional principles that should be integrated into multimedia to guide purchase and instructional decisions. They provide a list of specific programs that include these instructional principles, and their associated websites. Finally, they point out potential problems for students with disabilities and suggests interventions to correct these problems

(Wissick & Gardner, 2000). Both articles described should be included in readings for future educators who will be in the position of purchasing or designing CAI or multimedia in inclusive settings or more traditional programs for students with disabilities.

Word processing and written expression

Students with disabilities often find written expression to be an especially difficult area of the school curriculum. They experience difficulty with the higher order processes involved in writing such as planning and revising to clarify ideas, the transcription part of writing, and the mechanical aspects of writing (MacArthur et al, 2001). MacArthur et al. (2001) reviewed 20 investigations that examined these various parts of the writing process. Benefits from the use of technology were reported in 12 of them. Of these 12, five investigated the use of word processors and spell checkers combined with strategy instruction, writing instruction, or strategic peer revision. All five studies investigating this combined approach had positive results for students with disabilities. These studies may be an example of the importance of the active involvement of teachers if technology is to enhance academic achievement (Woodward & Rieth,1997).

WebQuests

As a result of passing the 1996 Telecommunications Act, many children in our nation's classrooms have increased access to the Internet. While there is little research on the impact of using the WWW on academic achievement, locating information on the World Wide Web is a regular activity for students. Along with searching for information, students use the WWW to conduct elaborate research projects (Goldstein, 1998). An increasingly popular learning task involves working with WebQuests (Kelly, 2000).

WebQuests are described as inquiry-oriented activities in the form of a webpage (Dodge, 1995). Activities are often designed using collaborative learning arrangements. Guidelines are available for designing webquests (Kelly, 2000). These guidelines are consistent with examples of WebQuests at the following website: http://edweb.sdsu.edu/webquest/webquest.html and include the following components described by Kelly (2000): (a) Introduction, (b) description of the specific task, (c) linked Internet resources, (d) steps to guide students to completion, (e) methods of evaluating student work, and (f) a conclusion linking the activity to state standards. Teachers are likely to find that using webquests provides students with the opportunity to engage in higher order thinking skills as they complete an authentic task.

Conclusion

The purpose of this article was to review existing research, and provide resources to guide teacher education programs as they review technology requirements for future teachers. Increasingly, all teachers must be prepared to meet the needs of students with disabilities in general education classrooms. As teacher education programs review their current technology requirements, they should keep on eye on research that can guide them in identifying promising practices. This article was written to provide an overview of such research-based practices.

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